# BIM Integration of Landscape Objects:
## Recording Water Consumption for Management and Digital Modeling

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The discipline of Landscape Architecture has always been on the cutting edge of designing and creating spaces to serve a purpose beyond simply existing. Unfortunately, landscape design has not always aligned well with the commonly available technologies of the design industry. Particularly, those technologies used for the 3-dimensional modeling of projects (i.e. Revit, Rhino, Grasshopper, etc.). In order for designs to reach their full potential from conception to construction, they must analyze as many facets as possible through each phase of design. Historically, this has been difficult due to the existing system of project design and delivery. The architect designs a wall system, but has to arrange a meeting with the structural engineer to ensure its stability; the lighting engineer designs a lighting system to meet requirements for a particular room, but the architect has changed the design at the last minute and therefore the lighting system is no longer compatible. These changes are sure to create change orders during the construction process. These change orders are always costly and often a “good enough” solution to a design or construction problem. Assuming these to be known truths and an integrated project delivery method will be established for future projects, this article will propose a new method for digital design integration that will help Landscape Architects to become involved earlier and more often through the design process.

As the construction process can currently be modeled in 4D (the fourth dimension being time) for buildings, it is an achievable goal for landscape applications as well. Currently, architects and engineers are able to apply specific intelligence to each component of a building. Every beam and girder can be altered in a multitude of ways with a few clicks of a mouse. The length, width, material, color or zone of construction can be adjusted quickly in a matter of seconds, to name just a few. While the current

landscape applications of such technology are still being explored, this inherent intelligence in objects, or components, can be seen as an important aspect of the future of digital modeling for landscape applications.

Landscape architecture students are taught early in their academic career to better manage water on sites to ensure project success and water quantity and quantity management. However, this commonly results in swales or drains running into large detention or retention ponds that appear to be copied directly from some sort of utilitarian design handbook. The problems with this are not only aesthetic, but environmental as well. Energy consumption by buildings is known to be a problem and we have gone great lengths to develop new technologies to offset this consumption. However, it commonly goes unnoticed that buildings currently consume 12% of the world's water (Building for the Future 1). Yes, we have developed double flush toilets and low-flow fixtures, but these are all efforts to combat a symptom of the actual ailment. We still must pump every ounce of that water past a meter and pay for its consumption while we spend even more money to get rid of stormwater as quickly as possible. What if instead of getting rid of stormwater to simply bring more water into our buildings, we simply collect the water that falls on site and use that for consumption? Rainwater that would typically be concentrated and immediately taken off site could be retained and used in order to offset the quantity of water a building would have to buy and pump from a distant treatment facility. Rainwater collection is a viable option even for buildings with relatively high consumption rates.

A few simple calculations can produce astonishing collection figures for any building design. One thousand square feet of roof area with a collection rate of just 75%

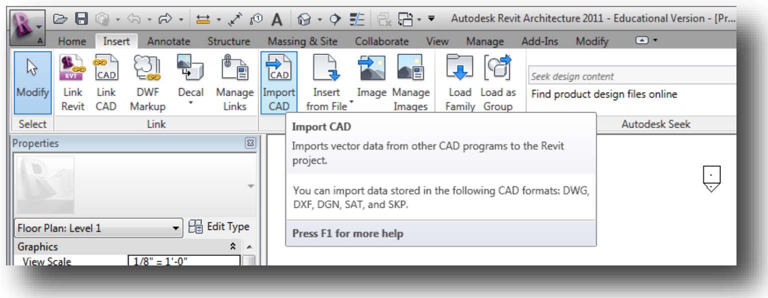
can generate over 155 gallons of ultimately potable water in just a quarter of an inch rain event (Rainwater Collection Calculator). A typical household uses roughly 260 gallons of water daily, over 100 of which are used for toilets (Conserving Water). Given that many geographic locations see regular storm events that exceed one quarter of an inch, and most residential buildings have a roof surface area greater than one thousand square feet, the potential to drastically reduce our dependence on public water supplies is quite great. Therefore, given the proper environmental factors and collection systems, a building could easily harvest more water even than it could consume providing enough average annual rainfall.

While a building consumes water, so does the landscape around it. LEED currently rewards points for landscapes that are water-efficient and provide innovative water management ideas (Green Building). This correlation between the building and the landscape so plainly demonstrated by the LEED checklist creates a wonderful opportunity for buildings to integrate with the landscape surrounding them. If a project has the potential to document and record its total water consumption for not just the building footprint and incorporated fixtures, but the entire limit of work, it poses an interesting opportunity for the growth of the practice of BIM as it applies to all disciplines. No longer is the building the only intelligent object in a plan, but the plants could also contain inherent intelligence properties that can be used for smarter construction and maintenance practices.

Planting plans are typically generated by landscape architects with computer programs that work relatively seamlessly with those programs employed by architects and engineers; one example being AutoCad (to maintain a similar license, Autodesk

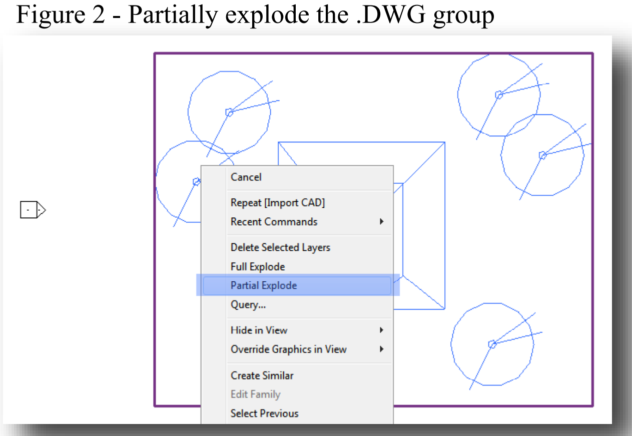
Revit will be used as the 3D BIM application for this example). Typically, a simple symbol (an AutoCad block) would be established and used to represent individual plant species throughout the plan.

Figure 1 - Import your .DWG planting plan




After finishing the planting plan the .DWG file can then be imported into your Revit model (see Figure 1). Each block will be recognized as an individual component after a right click and 'partial explode' command (see Figure 2). After the imported .DWG is partially exploded, select one block, right click and 'select all similar.' You now are able to edit every block of that plant species within the model. As I introduced previously, the inherent intelligence in components in modeling software provides unique design opportunities for landscape architects. Now each plant's unique water consumption needs can be attached as part of its inherent properties.

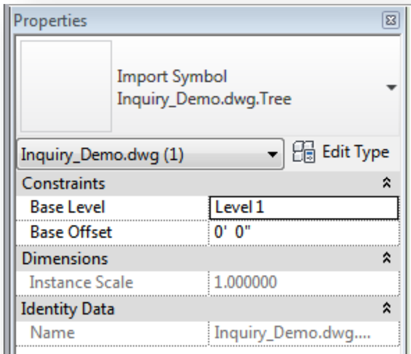
Figure 2 - Partially explode the .DWG group




By adding a simple tag or keynote to each symbol (or species) it is possible to monitor the amount of water every plant must consume in order to remain healthy. For example, assume the landscape architect has designed to plant five Northern Red Oak (Quercus Rubra) trees throughout a site. If, once the planting plan is imported to Revit, one of the Red Oak tree symbols is selected the attached information will be displayed on the properties window (see Figure 3). However, the imported information will be

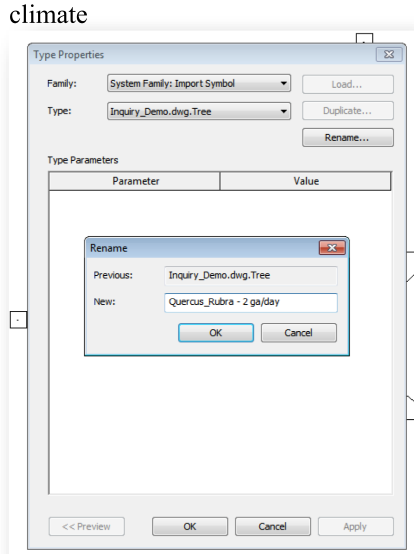
generated from the original .DWG file or the Autocad block. As Figure 3 demonstrates, the block created for this article was simply titled 'Tree.' As these blocks are uniformly edited, any change made to one, changes every one located in the model. This in mind, select one of the desired blocks and click the 'Edit Type' button in the properties window. This will open the 'Edit Type' window (see Figure 4). Rename the block to the proper species with its desirable water needs per maintenance requirements (i.e. 2 gallons of water per day). Click 'OK' to save and apply your changes.

Figure 3 - Careful naming of blocks saves time




Now, right click and 'select all similar' in the entire project and the properties tab will now display the same information, plus a number in parentheses after the name of the object selected (see Figure 5). The number in parentheses represents the total number of the selected object throughout the planting plan. Simply multiplying the required gallons of water per plant, by the total number of that species, will provide a baseline figure for the total water consumption of that species on site. Extrapolate this across an entire planting plan and one can quickly generate total water consumption figures for the entire landscape.

Figure 4 - Base water needs on your climate




This increase in modeling information is a new way to look at BIM as it can be applied to landscape architects. Now, landscape features and components can be digitally accounted for without sacrificing the size and speed of a digital model. Site renderings

can be generated through the locating of existing Revit components or through further program integrations (i.e. Adobe Photoshop or other image editing software) in order to further reduce modeling time.

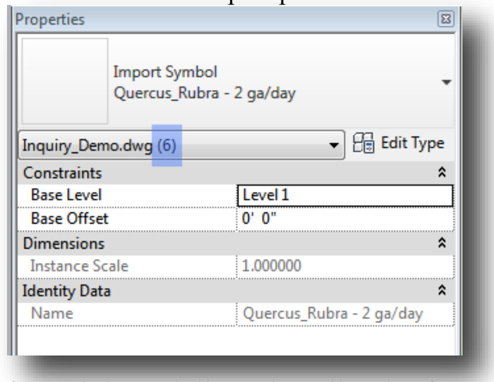



Figure 5 - Simply multiply this figure by the amount of water per species

In conclusion, digital models are created for a variety of reasons. Batty et al in Visualization of Spatial Modeling, describe the four primary reasons being, to simulate, explain, experiment, and communicate (Batty et al 2006). Digital modeling of buildings aids in early clash detection and change-order reductions over the course of a project's lifespan. This reduces total cost and lost time throughout every phase of the implementation of any design. The incorporation of this intelligence to the landscape can only help to create an even more seamless system of project conception through construction; further blurring the lines between disciplines and allowing for the presence and creation of a more fully integrated landscape that lends itself to the longevity of the project as well as its surrounding environment.

Works Cited

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